LOVING-KINDNESS MEDITATION TO ENHANCE THE PSYCHOLOGICAL RECOVERY OF INDIVIDUALS WITH PERSISTENT NEGATIVE SYMPTOMS OF SCHIZOPHRENIA: A PILOT STUDY

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ABSTRACT

DAVID P. JOHNSON: Loving-kindness meditation to enhance the psychological recovery of individuals with persistent negative symptoms of schizophrenia: A pilot study
(Under the direction of David Penn)

Background: A significant subgroup of individuals diagnosed with schizophrenia experience persistent negative symptoms, which are particularly important given the association with poor long-term functioning and prognosis. Currently, there are few well-established treatments for negative symptoms. Loving-kindness meditation (LKM) is an intervention focused on directing warm, compassionate feelings to the self and others. When tested with non-psychiatric samples, LKM was found to improve psychological well-being and deficits associated with negative symptoms. Methods: LKM was tested in an uncontrolled study design for its feasibility and initial efficacy in a pilot sample of 18 participants with schizophrenia-spectrum disorders who have persistent negative symptoms. Results: Findings suggest that the intervention is feasible and acceptable based on attendance rates and feedback from participants. Preliminary data also indicate that LKM was associated with increased positive emotions, decreased negative symptoms, and increased psychological recovery at post-treatment and 3 month follow-up assessments. Conclusions: Initial data about the efficacy of LKM are encouraging although an uncontrolled study design precludes strong conclusions until further testing is conducted. If future results are consistent with the current pilot study, LKM could be a promising intervention to enhance the recovery of individuals with negative symptoms.

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INTRODUCTION

Negative Symptoms

Negative symptoms have been identified in individuals with schizophrenia since Kraepelin and Bleuler began classifying this mental illness (Bleuler, 1908; Kraepelin, 1919, reprint 1971). Kraepelin described negative symptoms as an "avolitional syndrome," a "weakening of those emotional activities which permanently form the mainsprings of volition," that results in "emotional dullness, failure of mental activities, loss of mastery over volition, of endeavor, and of ability for independent action" (Kraepelin, 1919, reprint 1971). The most recent categorization of negative symptoms from the NIMH-MATRICS consensus statement on negative symptoms, distinguishes 5 factors: alogia, blunted affect, asociality, avolition, and anhedonia (Kirkpatrick, Fenton, Carpenter, & Marder, 2006). Research suggests alogia, or a lack of speech, and blunted affect, or a diminished physical expression of emotions, may represent a single factor (Blanchard & Cohen, 2006). While asociality (little interest in relationships), avolition (lack of motivation), and anhedonia (loss of pleasure) may be closely related, constituting another factor. Taken together, negative symptoms account for a significant amount of variance in long-term functioning and morbidity (Bowie, Reichenberg, Patterson, Heaton, & Harvey, 2006; Buchanan, 2007; Milev,

Ho, Arndt, & Andreasen, 2005; Peer & Spaulding, 2007; Tek, Kirkpatrick, & Buchanan, 2001).

Negative symptomatology is often categorized into two distinct classes based on etiology, duration and stability (Buchanan, 2007; Earnst & Kring, 1997). Primary symptoms describe the idiopathic symptoms inherent to the disorder of schizophrenia. These symptoms are thought of as enduring throughout the course of the illness, without fluctuation based on positive symptoms, affective symptoms, or medication status. Further categorization of primary symptoms specifies a subset of symptoms leading to the diagnosis of the deficit syndrome (Arango, Kirkpatrick, Buchanan, & Carpenter, 1998; Kirkpatrick, Buchanan, McKinney, Alphs, & Carpenter, 1989). Secondary negative symptoms describe the symptoms influenced by positive and affective symptoms, medication side-effects, or environmental factors. For example, a client whose anhedonia is mitigated by cognitive-behavioral treatment of depression and whose blunted affect is improved after a change in antipsychotic medications would be categorized as having secondary negative symptoms. However, despite conceptualization of the symptoms as secondary, treatment of the underlying factors (e.g. medication side-effects or depression) is not always successful in completely eliminating secondary negative symptoms. Therefore, some researchers have posited describing negative symptomatology based on its resistance to treatment instead of its underlying factors. A label of “persistent negative symptoms” would include both primary symptoms and secondary negative symptoms that do not respond to treatment of underlying factors. These criteria are also more clinically meaningful as they define clients by their treatment needs (Buchanan, 2007).

A review of numerous clinical and population-based studies suggests that 15-20% of the population of individuals diagnosed with schizophrenia have significant primary negative symptoms (Buchanan, 2007). No studies have assessed the prevalence rate of individuals with persistent negative symptoms, although this is assumed to be larger than 15-20%, as this category would include clients with primary symptoms and clients with treatment-resistant secondary negative symptoms (Buchanan, 2007). Therefore, the classification of clients with persistent negative symptoms helps to identify a significant subpopulation of those with schizophrenia who should have specific treatments designed to meet their needs. Next, I review etiological models of negative symptoms, as these should form the basis of pharmacological and psychosocial interventions.

Theories of the etiology of negative symptoms

Biological theories

Biological models suggest specific neurotransmitter pathways and areas of the brain with implications for both avolition and anhedonia. Biological theories of avolition hypothesize a modulation of frontal lobe cortical activity resulting from a depletion of striatal dopamine via the striato-thalamo-cortical circuit (Alexander, Crutcher, & DeLong, 1990). Another hypothesis places importance on mesolimbic dopamine and its role in anticipatory pleasure and motivation via the signaling of rewards and reward-predicting events as well as the processes of learning and memory (Berridge & Robinson, 2003; Smith, Becker, & Kapur, 2005; Spangel & Weiss, 1999; Wittmann et al., 2005). Indeed, recent neuro-imaging studies found that decreased activity in the mesolimbic dopamine system was correlated with increased negative symptoms (Juckel et al., 2006; Taylor, Phan, Britton, & Liberzon, 2005).

Additional areas of the brain implicated in negative symptoms are the prefrontal area, nucleus accumbens, amygdala and ventricles (see reviews by Brown & Pluck, 2000; Earnst & Kring, 1997). Therefore, mesolimbic and mesocortical dopamine hypofunction seem linked to the core deficits of avolition and anhedonia.

Psychological Theories

The literature on psychological theories of negative symptoms delineates two theories: one based on the importance of cognitions and the other based on the role of anticipatory pleasure. However, these two theories are actually congruent with each other as the anticipatory pleasure model retains the ability to incorporate the principles of the cognitive model. This is discussed in more detail below.

Cognitive Model

The cognitive model posits that negative symptoms are the result of low expectations about an individual's ability to experience pleasure, success, and acceptance (Rector, Beck, & Stolar, 2005; Stolar, 2004). The individual is conceptualized as experiencing distorted cognitions and therefore he has a negatively biased evaluation of his ability to succeed at a planned behavior (avolition), the amount of pleasure he will receive from that behavior (anhedonia), and whether he will be accepted by others (asociality). Additionally, negative cognitions about the perception of limited resources affect an individual's negative symptoms. For example, "I don't have the ability to express my feelings" (blunted affect) or "It takes too much effort to talk" (alogia).

The cognitive model is conceptualized as playing an important role in both primary and secondary negative symptoms (Stolar, 2004). If the etiology of negative symptoms is

attributed to physiological disruptions (as in primary causes), then cognitions are examined relating to the interpretations made about these deficits. For example, an individual may believe that he will never be able to feel the same amount of pleasure as before the onset of the illness. This interpretation is conceptualized as leading to further distress and exacerbation of the symptom. Secondary negative symptoms caused by depression, demoralization, and fear of rejection are also hypothesized to have cognitive etiologies based on negative automatic thoughts.

Empirical support for this model is limited as of yet; however, some studies do suggest an association between beliefs and negative symptoms. First, research supports the hypothesis that individuals with schizophrenia endorse defeatist attitudes about their performance to a greater extent than a non-clinical control sample (Beck & Grant, 2008). Additionally, individuals with more negative symptoms tend to endorse these defeatist beliefs to a greater extent than those with less negative symptoms (Rector, 2004). These studies measured participant's cognitions using the Dysfunctional Attitudes Scale (DAS; Weissman, 1978) and found that the associations between negative symptoms and defeatist beliefs remained significant even after controlling for depressive and positive symptomatology. Additionally, path-analyses supported defeatist beliefs as a significant mediator of the relationship between cognitive impairments and negative symptoms (Grant & Beck, 2008). Therefore, this research suggests that the interpretation an individual makes regarding their cognitive deficits plays an important role in accounting for their expression of negative symptoms.

Anticipatory Pleasure Model

The anticipatory pleasure model places anhedonia as a core feature relevant to the etiology of negative symptoms, particularly avolition and asociality. Although all the negative symptoms are associated with poor prognosis and functional impairment, anhedonia may have a particularly strong association with impaired functioning as investigated in longitudinal studies (Herbener, Harrow, & Hill, 2005). Anhedonia can be divided into impairments in anticipatory pleasure (i.e., pleasure related to expectations regarding future events) and consummatory pleasure (i.e., ability to enjoy something at that moment) (Gard, Gard, Kring, & John, 2006; Gard, Kring, Gard, Horan, & Green, 2007; Horan, Kring, & Blanchard, 2006). These conceptual distinctions correspond well with research from animal models and neural imaging, which suggest that anticipatory pleasure is more closely associated with dopamine and the mesolimbic pathway while consummatory pleasure is related more to serotonin and opiod systems (Berridge & Robinson, 1998; Schultz, 2002; Wise, 2002). Anticipatory pleasure can be further divided into an emotional and cognitive construct, involving both an individual's beliefs about future positive emotions and the immediate positive emotions garnered when considering a future experience (Gard et al., 2007).

Recent research has investigated the components of anhedonia in individuals with schizophrenia, finding consummatory pleasure to be largely intact while deficits are found in anticipatory pleasure compared to non-clinical control participants (Gard et al., 2007). These results are consistent with the previously discussed biological research on negative symptoms that has found deficits in the brain correlates of anticipatory pleasure. Anticipatory pleasure was also found to be positively correlated with the reward motivation and social networks of individuals with schizophrenia (Gard et al., 2007). Additionally, anticipatory pleasure has

been found to relate to motivation and the pursuit of goal-directed behavior in non-clinical samples (Carver, 2001; Schultz, 2002). Consequently, an individual who cannot anticipate enjoying an activity in the future will have little incentive to work toward it (avolition). Likewise, an individual who cannot anticipate enjoying a social relationship in the future will have little interest in fostering that relationship (asociality). This theory is also supported by factor analytic research identifying anhedonia, avolition, and asociality loading on the same negative symptom factor (Blanchard & Cohen, 2006). Therefore, the anticipatory pleasure model of negative symptoms includes principles from the cognitive model while illustrating how anticipatory pleasure is critical to understanding avolition and asociality (see figure 1).

In summary, the etiological theories of negative symptoms place an important role on anticipatory pleasure. Biological research emphasizes cortical pathways associated with rewards while psychological research posits the importance of cognitive and emotional bases of pleasure, motivation, and sociality. It follows that treatments for negative symptoms should target cognitive and emotional deficits related to pleasure, motivation, and sociality.

Treatment of Negative Symptoms

Pharmacological Treatment

Psychopharmacological studies of the treatment of primary or persistent negative symptoms demonstrate mixed results using antipsychotics, glutamatergic agents, or selective monoamine oxidase B inhibitor (Buchanan, 2007). These inconclusive results may be due to a limited number of studies, small sample sizes, inconsistencies in study design, duration of treatment, and the level of assessment of depressive and extra-pyramidal symptoms which obfuscate targeted primary negative symptom outcomes (Buchanan, 2007). However, even

the studies demonstrating positive results of medications suggest only small to medium effect sizes for treating negative symptoms (Buckley & Stahl, 2007).Additionally, there seems to be little understanding of the mechanisms of change using psychopharmacological treatments for negative symptoms. Given the somewhat limited efficacy of psychopharmacological approaches, there is a strong need for increased research on alternative approaches to treating negative symptoms.

Previous psychosocial treatments for the negative symptoms of schizophrenia spectrum disorders can be divided into 3 treatment approaches: activity-based therapy, cognitive-behavioral therapy (CBT), and integrated therapy (IT). The results and limitations of studies conducted on these approaches are summarized below.

Activity-based Therapy

Activity-based approaches are treatments focused on some specific behavior or activity done by the client or together with a therapist and/or group. The primary activity-based treatment for negative symptoms is music therapy, defined as the therapeutic incorporation of any of the following components: music listening, music playing, and discussion of music. In a review of four randomized controlled trials incorporating group or individual music therapy for inpatients with schizophrenia, three of them reported data on negative symptoms (Gold et al., 2005). A meta-analysis of these studies demonstrated a standard mean difference of -0.86, indicating a large effect of music therapy on the reduction of negative symptoms. Recently this finding was replicated in another controlled study of music therapy for inpatients with schizophrenia (Ulrich, Houtmans, & Gold, 2007). Music therapy appears particularly beneficial because the interventions are relatively short, including one study that found positive results after only 1 month (Yang et al., 1998).

However, all of the reviewed studies only evaluated outcomes at post-treatment leaving questions about the long-term stability of the treatment. Also, two studies that also measured quality of life did not find any significant improvement resulting from music therapy over standard care, bringing into consideration whether the reductions in negative symptoms translated into client-relevant changes (Ulrich, 2004; Ulrich et al., 2007). Additionally, music therapy for negative symptoms has only been compared to treatment-as-usual, and therefore, strong conclusions cannot be drawn about the mechanism of change. Finally, music therapy for schizophrenia has only been tested on inpatients and results may differ in outpatient settings.

Other activity-based treatments include vocational therapy and animal-assisted therapy, which have only preliminary support for the treatment of negative symptoms in schizophrenia. Paid vocational therapy (i.e. paid employment) was found to improve motivation and anhedonia compared to a volunteer work condition (Bryson, Lysaker, & Bell, 2002). However, this study employed the Heinrichs Quality of Life Scale (Heinrichs, Hanlon, & Carpenter, 1984), which does not represent the currently agreed upon negative symptom factors. In fact, the subscale used to measure motivation and anhedonia (Intrapsychic Foundations) also includes constructs outside the traditional negative symptom factors, such as empathy and sense of purpose, which may have impacted the results. Animal-assisted therapy teaches participants to care for and play with a domestic pet (Gammonley et al., 1997). Animal-assisted group therapy was compared to an active control group in 20 inpatients with schizophrenia and found to significantly improve anhedonia but not overall negative symptoms (Nathans-Barel, Feldman, Berger, Modai, & Silver, 2005). Therefore, paid vocational therapy and animal-assisted therapy are in the earliest stages of testing for the

treatment of negative symptoms. Music therapy appears to be the most promising line of treatment thus far, although more research is needed as it has never been tested in outpatients, with an active control group, or using long-term follow-up assessments. Additionally, these treatments pose potential problems as many individuals with schizophrenia would have difficulty accessing necessary resources such as pets and musical instruments upon completion of the research

Cognitive Behavioral Therapy

In contrast with the limited research on activity-based treatments, a large body of research has been conducted on CBT for schizophrenia (although not specifically negative symptoms). In a meta-analysis of 23 randomized controlled trials which included a total sample of 1268 participants, CBT for psychosis showed a moderate effect size of .44 in favor of the reduction of negative symptoms (Wykes et al., 2008). However, after including only trials categorized as having rigorous methodology according to the Clinical Trial Assessment Measure (Tarrier & Wykes, 2004), reanalysis found a small effect size of .21 for reducing negative symptoms. Additionally, although a cognitive model for the treatment of negative symptoms exists, only 2 out of 34 CBT studies included in this meta-analysis were independently rated as primarily targeting negative symptoms (Bailer, Takats, & Westermeier, 2001; Daniels, 1998). The first of these studies incorporated 3 months of individual CBT into standard care and found significant improvements in participants' negative symptoms that persisted through a 3 month follow-up assessment (Bailer et al., 2001). Daniels (1998) approach to CBT for negative symptoms emphasized promotion of group process that would motivate participants to translate learned skills into their personal lives. However, results indicated no significant improvement in overall negative symptoms

or on the asociality factor. Additionally, a small CBT group pilot study targeting negative symptoms found no effect on negative symptoms overall, but the treatment did significantly reduce participants' avolition (Johns, 2002).

Therefore, empirical evidence suggests that CBT has only a small effect on negative symptoms after considering only the most rigorous clinical trials. This small effect may be partly due to the limited studies that explicitly targeted negative symptoms with CBT. However, this may also be the result of the detrimental impact that negative symptoms have on social learning, which in turn, might cause a poor therapeutic response to CBT and skills training approaches (Hoffman & Kupper, 1997; Kopelowicz, Liberman, Mintz, & Zarate, 1997).

Integrated Therapy

The final group of treatments, IT, integrates multiple components and treatment approaches, such as family therapy, social skills training, CBT coping strategies, assertive community treatment, psychoeducation, and behavior scheduling. Studies conducted on IT can be divided based on the inclusion or exclusion of *a priori* hypotheses about the impact of treatment on negative symptoms.

IT focusing on the impact of treatment on overall symptoms found that the interventions did reduce negative symptoms. Specifically, one study of cognitive-behavioral family treatment incorporated skills training, cognitive-behavioral strategies for residual psychotic and non-psychotic problems, and home-based crisis management compared to standard care (Grawe, Falloon, Widen, & Skogvoll, 2006). This study found significant improvements in the negative symptoms of participants in IT compared to those in standard care after 2 years of treatment. Another study of family therapy included illness management

and psychosocial skills training and found significant reductions in negative symptoms after 1 year of treatment compared to standard care (Valencia, Rascon, Juarez, & Murow, 2007). However, these long-term studies are limited in interpretation simply due to the vast difference in number of contact hours between the treatment and control conditions. The treatments also contained multiple components making it difficult to determine which led to reductions in negative symptoms. Finally, these studies lacked a clear theoretically informed rational for impacting negative symptoms.

IT specifically designed to target negative symptoms has had mixed results. A 2-year IT incorporated psychoeducation, social skills training, and optional family psychoeducation groups and found the intervention significantly reduced negative symptoms; however, unblinded raters, low interrater reliability, and differential attrition rates seriously limit the conclusions of the study (Thorup et al., 2005). A small pilot study targeting negative symptoms used a coping-oriented group therapy to integrate psychoeducation for the participant and family members, coping skills, and behavior scheduling (Andres, Pfammatter, Garst, Teschner, & Brenner, 2000). This 24-session long IT had an effect size reduction of 1.4 for negative symptoms compared to 0.8 for Supportive Therapy. However, the small sample size (n= 32) permits only preliminary conclusions about the intervention's efficacy. A large randomized clinical trial investigated a treatment called Training of Self-management Skills for Negative Symptoms (TSSN), which was designed to target negative symptoms using behavior scheduling, social skills training, and motivational techniques (Vauth et al., 2005). However, even when TSSN was combined with vocational rehabilitation, the study found no significant effects on negative symptoms. Therefore, IT has some initial support for its efficacy, however, methodological flaws and a lack of theoretical

rationale for some of these studies make interpretations difficult. Additionally, the most critical feature of these IT are their long-term nature, making them difficult to implement for individuals with low motivation who are less likely to complete a lengthy treatment course.

In sum, psychopharmacological, CBT and IT approaches have initial support for the treatment of negative symptoms; however, studies conducted with methodological rigor suggest only small effect sizes. These findings also indicate the potential shortcomings of the biological and cognitive theories of negative symptoms. There does appear to be some support for the treatment of negative symptoms using activity-based therapies, particularly music therapy. However, the feasibility of this approach to treatment may be limited because the requisite musical instruments may not be readily available to clients after the study ends, thereby limiting its long-term efficacy. Therefore, other psychosocial interventions for negative symptoms should be explored, particularly those that teach coping skills which will continue to foster recovery after the treatment period. Also, activity-based and IT currently lack a theoretical rationale for their impact on negative symptoms. Thus, it is essential that any psychosocial intervention have a sound theory on which treatment is based, particularly one that could provide a framework addressing how anticipatory pleasure may impact negative symptoms. One such theory is the broaden-and-build theory of positive emotions.

Broaden-and-build theory of positive emotions

A substantial body of empirical evidence within the normal population indicates that negative emotions narrow an individual's action tendencies, which may have been evolutionarily adaptive for survival (e.g. anger or fear leads to fight or flight). The broaden-and-build theory of positive emotions takes a complementary position and posits that positive emotions broaden an individual's momentary thought-action repertoire; the accrual over time

of these broadened moments then leads an individual to think and behave in a way that builds personal resources (Fredrickson, 1998, 2001). This building of physical, social, intellectual, and psychological resources then provided an evolutionary advantage by increasing chances of survival. Additionally, the accrual of these resources is durable, unlike the transient nature of positive emotions, and leads to increased satisfaction in life. This challenges distinctions between hedonic well-being, or the mere enhancement of positive emotions, and eudemonic well-being, defined as the striving toward one's potential and purpose in life (Ryan & Deci, 2001). These forms of well-being may be related where hedonic well-being leads to eudemonic well-being through the accumulation of resources.

This theory holds special importance because of its potential applicability to treatment of the negative symptoms of schizophrenia. If positive emotions broaden thought-action repertoires and build resources, then some of these resources could include increased sociality, motivation, and anticipatory pleasure, which are core deficits associated with the negative symptoms of schizophrenia. In turn, this theory indicates that improvements in these resources affect life satisfaction, which is likely to be low in individuals with negative symptoms given their poor prognosis and impaired functioning.

The broaden-and-build theory is backed by a strong empirical foundation of research demonstrating that positive emotions broaden the thought-action repertoire. For example, studies show that individuals experiencing positive emotions demonstrate thinking that is notably unusual, flexible, creative, integrative, open to information and efficient (see review by Isen, 2000) as well as having a broadened repertoire of desired actions (Fredrickson & Branigan, 2005). Likewise, prospective correlational studies suggest that individuals experiencing more frequent positive emotions build psychological resources such as

optimism and resilience (Cohn, Fredrickson, Brown, Mikels, & Conway, 2008; Fredrickson, Tugade, Waugh, & Larkin, 2003) and social resources such as improved quality of relationships (Gable, Gonzaga, & Strachman, 2006; Gable, Reis, Impett, & Asher, 2004; Waugh & Fredrickson, 2006). However, the association between broadened thought-action repertoires and built personal resources has only limited and indirect support, partly due to the difficult nature of finding an intervention that consistently induces positive emotions (Fredrickson, Cohn, Coffey, Pek, & Finkel, 2008). This phenomenon of adaptation describes the tendency for an individual to return to a baseline set-point of well-being once novelty has subsided and would likely affect laboratory-based tasks such as watching pleasant films (Diener, Lucas, & Scollon, 2006).

The "build" hypothesis was recently tested when Frederickson and colleagues (2008) identified an approach that improves positive emotions and is relatively immune from hedonic treadmill effects: meditation. Unlike laboratory tasks, meditation is active and personalized, and insights gained from it can be applied to a variety of situations and life domains. In a wait-list control design using a non-clinical sample of 141 participants, the broaden-and-build theory of positive emotions was tested using loving-kindness meditation (LKM; Salzberg, 1995), a type of concentration meditation focused on directing warm, compassionate feelings to self and others (Fredrickson et al., 2008). The study found that the meditation group led to more positive emotions over the course of the 6 weeks than the control group, a necessary step to testing the build hypothesis. The amount of time participants spent meditating outside of the group session was also a significant predictor of increased positive emotions as well as positive emotions during social interactions. The study was unable to assess broadening due to the inherent difficulties of measuring this construct

outside of a lab setting. However, results did show that an increase in positive emotions was significantly associated with a building of resources including mindfulness, anticipatory pleasure, hope, environmental mastery, self-acceptance, purpose in life, social support and relationships, and lower physical illness symptoms. The final part of the theory was also supported demonstrating that positive emotions alone did not lead to increased life satisfaction but instead the changes in personal resources mediated increased satisfaction with life.

There have been four other empirical studies of LKM to date, which all found results consistent with the broaden-and-build theory of positive emotions. First, a study of LKM was conducted using a non-clinical sample where participants were asked to either engage in several minutes of LKM or a closely matched control task (Hutcherson et al., 2008). The study found that participants practicing LKM had a significant increase in mood compared to the control condition. Most importantly, LKM participants also had significant increases in positivity towards others on an explicit and implicit level compared to the control group. Additionally, changes in positive mood were found to account for a significant amount of variance in explicit positivity towards others, suggesting support for the broaden-and-build theory of positive emotions. Second, a study of brain activity during LKM was conducted using fMRI with novices and "experts" in meditation, defined as practicing Buddhist meditation for over 10,000 hours (Lutz, Brefczynski-Lewis, Johnstone, & Davidson, 2008). The study analyzed limbic areas typically associated with empathic responses to others while participants were practicing or not practicing LKM. The study concurrently examined neural activity during emotional human vocalizations (positive, neutral, or distressed) designed to generate empathy in participants. Results suggested a significant 3-way interaction where the

greatest limbic response (and hypothesized empathic response) resulted from expert meditators hearing distressed vocalizations during LKM. This study suggests that LKM may alter areas of the brain associated with empathy towards others, which could play a role in the building of relationships. In fact, it may be that empathy is one of the psychological resources built by the accumulation of positive emotions induced during LKM. The third study of LKM piloted the intervention in a small group of chronic pain patients and found that LKM significantly reduced pain and distress compared to a standard care control group (Carson et al., 2005). Most recently a study of college students compared LKM alone, mindfulness alone, LKM & mindfulness (combination), and a control group (Sears & Kraus, 2009). This study found that the combination group yielded the greatest improvements in anxiety, negative mood, and hope. Additionally, across treatment group, a reduction in cognitive distortions was found to be a significant mediator of these outcomes. In sum, these additional studies of LKM improved participants' mood, attitudes towards others, and hope while also reducing physical pain and psychological distress. These outcomes can be considered built resources according to the broaden-and-build theory of positive emotions.

These studies have implications for the treatment of negative symptoms and the enhancement of psychological recovery of individuals with persistent negative symptoms. The aforementioned research found that LKM improved anticipatory pleasure and social connectedness in non-clinical samples (Fredrickson et al., 2008). Therefore, LKM may have promise in ameliorating the specific deficits of anhedonia and asociality found in individuals with negative symptoms via the mechanism of increasing positive emotions. Additionally, LKM was found to improve participants' hope, self-acceptance, environmental mastery and purpose in life. These constructs are synonymous with how individuals with severe mental

illness describe “psychological recovery”, according to a review of qualitative research (Andresen, Oades, & Caputi, 2003). Conducting LKM in a group setting may also provide the additional benefits of therapeutic group process factors, such as universality, acceptance and interpersonal learning (Yalom, 1995). In fact, research supports the relationship between group process factors and long-term improvements in functioning in individuals with severe mental illness (Yalom, 1995). However, before testing this intervention in a clinical population, it is necessary to review any existing research on meditation in general and its application to the treatment of schizophrenia.

Meditation

Meditation has been defined as the act of inward contemplation and the intermediate state between attention to a stimulus and complete absorption in it (Taylor, 1999). Many different practices and techniques exist within mediation; basic categorization distinguishes meditations based on concentration or mindfulness, although there is a significant amount of overlap (Ivanovski & Malhi, 2007). Concentration meditation is conceptualized as the focusing of one’s attention onto a specific stimulus, such as a thought or image, to enhance clarity and awareness. Concentration meditations include various forms of yoga, Transcendental meditation, and LKM. Mindfulness meditation is an expansion of awareness to become non-judgmentally aware of one’s internal experience and includes Zen and Vipassana meditation (see review by Ivanovski & Malhi, 2007).

Growing evidence suggests that both concentration and mindfulness meditation are associated with a variety of clinical benefits, including anxiety and stress regulation, reduction of chronic pain, and management of medical illnesses (for reviews, see Baer, 2003;

Delmonte, 1985; Kabat-Zinn, 2003a). Mindfulness meditation has been incorporated into several therapeutic approaches including mindfulness-based stress reduction (MBSR; Kabat-Zinn, 2003b), mindfulness-based cognitive therapy (MBCT; Teasdale, 2004), acceptance and commitment therapy (ACT; Hayes, Strosahl, & Wilson, 1999); and dialectical behavior therapy (DBT; Scheel, 2000).

Meditation in Psychotic Disorders

Within meditation, less work has been conducted with individuals with psychotic disorders particularly when using concentration meditations. However, pilot studies suggest that meditation has promise in this clinical population. Specifically, in an uncontrolled trial, a 6-week mindfulness meditation group intervention was associated with an increase in well-being and improvement in functioning among 11 individuals with schizophrenia spectrum disorders (Chadwick, Taylor, & Abba, 2005). In a qualitative study, 8 inpatients on an acute unit attended mindfulness groups and reported feelings of relaxation and peace, as well as a desire to continue practicing mindfulness after discharge (York, 2007). In another study of 113 psychiatric inpatients, one session of Hatha yoga, a concentration meditation, was found to significantly reduce negative emotions in participants immediately after practice (Lavey et al., 2005). In addition, many individuals with severe mental illnesses such as schizophrenia have interest in and practice meditation. In a sample of 157 adults with severe mental illnesses (25% schizophrenia), meditation was the second most commonly used alternative health care practice (Russinova, Wewiorski, & Cash, 2002). Finally, one of the interventions that incorporates mindfulness-based practices (i.e., ACT) has been shown to reduce distress associated with psychotic symptoms and hospitalizations among inpatients with psychotic disorders relative to treatment as usual (Bach & Hayes, 2002; Gaudiano & Herbert, 2006).

Nonetheless, the literature is cautious about the parameters of using meditation with individuals diagnosed with a psychotic disorder due to several case studies of meditation precipitating psychotic episodes (see review in Yorston, 2001) . However, these isolated case studies almost always involved extreme amounts of meditation while being deprived of food and sleep; none resulted from clinical studies.

Thus, LKM has initial support for its ability to generate positive emotions in the general population, which builds the resources of anticipatory pleasure and social connectedness that are specifically lacking in individuals with persistent negative symptoms. Additionally, studies of meditation with individuals with severe mental illness show it has been utilized as an alternative medicine practice suggesting its adequate treatment satisfaction in this population. Existing research also supports improvements in well-being, functioning, positive emotions, and reduction in negative emotions in psychiatric inpatients who participated in meditation groups. Therefore, LKM needs to be further investigated as a potential treatment for the amelioration of negative symptoms of schizophrenia and the improvement of psychological recovery.

Overview of Current Study and Hypotheses

The current study is an initial evaluation of LKM regarding its feasibility and potential clinical utility for individuals with schizophrenia with persistent negative symptoms. An uncontrolled clinical trial of LKM was conducted to evaluate clinical and psychosocial benefits, feasibility, tolerability, and qualitative client impressions of the treatment. Figure 2 illustrates the conceptualization of LKM on the hypothesized outcomes.

Primary hypotheses for the pilot study of LKM are:

1) LKM will be *well-tolerated, favorably received, and feasible* to implement in a group setting (based on client feedback, attendance and attrition rate, and time spent meditating outside of the group).

2) LKM will be associated with improvements (i.e., within-group effects) with respect to the primary outcome of *positive affect*, measured directly before and after each LKM session as well as from baseline to follow-up.

3) LKM will be associated with improvements (i.e., within-group effects) with respect to the primary outcome of *negative symptoms*, specifically the anhedonia, avolition, and asociality factor. Additionally within anhedonia, LKM is hypothesized to be associated with specific improvements in *anticipatory pleasure*.

4) LKM will be associated with improvements (i.e., within-group effects) with respect to the secondary outcome of psychological recovery as defined by subscales of psychological well-being, hope, and satisfaction with life.

The ultimate aim of the pilot study was to investigate the feasibility and client-tolerance of the treatment, which provides the foundation for a randomized controlled trial (RCT) of LKM to offer a more stringent test of its efficacy. This stepwise process is consistent with recent recommendations for the development of evidence-based treatments (Mueser & Drake, 2005). The methodology of the current pilot study is described in detail in the following section.

CHAPTER 2

METHODS

Participants

A total of 18 individuals with schizophrenia-spectrum disorders were recruited from three different settings: 1. UNC-Chapel Hill, School of Medicine, Schizophrenia Treatment and Evaluation Program (STEP) 2. UNC-Chapel Hill, School of Medicine, Outreach and Support Intervention Services (OASIS) program 3. Caramore Community, Inc., an assisted living program for severe mental illness based in Carrboro, NC. To be eligible for the study, a potential participant must have met the following criteria: 1.) met full DSM-IV diagnostic criteria for a schizophrenia-spectrum disorder based on chart review; 2) was between the ages of 18-60; 3) have an IQ greater than 80 as measured by the Wechsler Abbreviated Scales for Intelligence (WASI; The Psychological Corporation, 1999); 4) did not meet current criteria for substance dependence based on chart review/physician interview; 5) demonstrated prominent negative symptoms based on a score of moderate on one domain of the Negative Symptom Rating Scale (Kring, 2008); 6) had little experience with LKM; 7) did not have current or prior traumatic brain injury, stroke, seizure disorder, or any other neurological disease/condition based on chart review/physician interview; and 8) did not suffer from prominent medication side effects that may have resulted in persistent secondary negative symptoms as based on physician interview. Demographic characteristics of the sample are summarized in Table 1.

Measures

Screening measures

Wechsler Abbreviated Scales for Intelligence (WASI; The Psychological Corporation, 1999). This structured clinical assessment is used to assess intelligence and has well-established validity and reliability with a population of individuals diagnosed with schizophrenia. The WASI was used to rule out any individuals who did not possess the cognitive abilities to follow the instructions of the meditation facilitator (IQ < 80). The two subtests that were used to calculate the participant's full-scale IQ are Matrix Reasoning and Vocabulary.

Demographic Questionnaire (developed for the study). This self-report questionnaire was used to assess the participant's age, current medications, education, gender, psychiatric history, ethnic background, and previous experience with meditation.

Psychiatric Symptoms

Negative Symptom Rating Scale (NSRS; Kring, 2008). This semi-structured interview provides a 7-point anchor system on 23 items to enable a clinical interviewer to assess the severity of five domains of negative symptoms reflected in the recent NIMH-MATRICS consensus statement: anhedonia, asociality, avolition, blunted affect, and alogia (Kirkpatrick et al., 2006). A major theme of the NSRS distinguishing it from existing measures is its focus on the experiential aspects of negative symptoms that are considered to be at the conceptual core of the emotional, social, and motivational deficits that define negative symptoms. The NSRS also avoids confounding experiential deficits in hedonic capacity or drive with

behavioral success or functional outcomes. For example, an individual who has no friends due to lack of social skill or opportunity but who would like to be in a close relationship will not receive a similar score on the asociality subscale with someone who has no friends but also prefers to be alone. Psychometric analyses in this pilot study found that the subscales had adequate internal reliability except for the avolition subscale, which was not used alone in further analyses (NSRS total=.73; anhedonia=.87; asociality=.56; avolition=.07; blunted affect=.80; alogia=.95). The internal consistency of the asociality subscale was borderline acceptable and should be interpreted cautiously.

Brief Symptom Inventory (BSI; Derogatis, 1993; Derogatis & Spencer, 1982). This 53-item self-report instrument is designed to measure psychological symptoms and distress and has excellent psychometric properties in both clinical and nonclinical populations (Derogatis, 1993); (Derogatis & Spencer, 1982). Respondents choose from a 5-point scale (0=not at all, 4= extremely) that represents the extent to which each problem or complaint has caused distress in the last month. Nine symptom constructs are obtained from the measure as well as three global indices of distress. The *Positive Symptom Total* represents the number of symptoms endorsed The *Positive Symptom Distress Index* represents the respondent's severity of distress; and the *Global Severity Index* includes information about both number of symptoms and distress (cronbach's alpha=.96).

Calgary Depression Scale (CDS; Addington, Addington, Maticka-Tyndale, & Joyce, 1992). This 9-item structured interview is designed to measure depressive symptoms with each item using a 4 point scale anchored by descriptors. The CDS has excellent psychometric

properties for schizophrenia spectrum disorders and a cronbach's alpha of .71 in the current study.

Emotions

Modified Differential Emotions Scale (mDES; for original see Izard, 1977, for modified see Fredrickson et al., 2003). Participants rated the frequency with which they felt each of 26 emotions during the past two weeks on a 5-point scale (0= not at all, 4= most of the time). The positive emotion subscale consists of 13 items (amused, awe, excitement, grateful, hopeful, in control, inspired, joyful, interested, love, proud, satisfied, serene) and the negative emotion subscale consists of 13 items (angry, ashamed, bored, contempt, disgust, embarrassed, guilty, hatred, rejected, sad, scared, stressed, tired). The internal consistency of the subscales in the current study was .87 (positive emotions) and .92 (negative emotions).

Weekly Mood Scale (developed for the study). This 2-item self-report questionnaire uses a 4 point Likert-type scale to assess the intensity of pleasant and unpleasant emotions the participant is feeling at the moment. This measure was administered immediately prior to and after each LKM session.

Day Reconstruction Method (DRM; Kahneman, Krueger, Schkade, Schwarz, & Stone, 2004). The DRM assesses emotion experiences episode-by-episode during a specific day. With the help of the interviewer, participants divided their afternoon prior to the assessment into a continuous series of episodes and provided a descriptive label for each episode. We allowed a maximum of 10 episodes from lunch to dinner. Thereafter and working individually, participants revisited each labeled episode to provide intensity ratings

from *not at all* (0) to *extremely* (9) for the positive and negative emotion adjectives from the mDES (Frederickson et al., 2003). The

DRM methodology capitalizes on the strengths of time-budget measurement and experience sampling, which are less influenced by the recall bias of retrospective surveys.

Informant Questionnaire (developed for the study). Participants in the second cohort were asked to invite up to 5 people with whom they interact regularly to participate as informants in the study. Online invitations, consent forms, and access to the questionnaire were sent to these informants at baseline, post-treatment and 3 month follow-up assessments. Informants indicated the number of interactions they had with the LKM participant the day prior to completing the questionnaire as well as the length of the most significant interaction. Informants completed several likert-type questions rating the closeness and overall quality of the relationship. Finally, informants completed the mDES from the perspective of the participant, rating the frequency that he or she felt each positive and negative emotion during the previous 2 weeks.

Cognitive Resources

Temporal Experience of Pleasure Scale (TEPS; Gard et al., 2006). Anticipatory pleasure was rated by participants using the 10-item anticipatory pleasure subscale of the TEPS. This subscale assesses the amount of pleasure an individual derives from looking forward to experiences. For example, “When ordering something off the menu, I imagine how good it will taste.” Participants then rated how true this statement is for them on a 6 point Likert-type scale (0= very false for me, 6= very true for me). The TEPS has excellent estimates of reliability and has convergent validity for use with individuals with

schizophrenia (Gard et al., 2007). The internal consistency of the subscales in the current study were .71 (anticipatory pleasure) and .80 (consummatory pleasure).

Savoring Beliefs Inventory-anticipating (SBI; Bryant, 2003). The SBI assessed the participants' tendency to enjoy pleasant experiences. The current study used only one of the subscales from the measure: participants' ability to pleasurably anticipate experiences beforehand (*Savoring the Future*). Participants indicated agreement on a 7-point scale with 8 items, including "I feel a joy of anticipation when I think about upcoming good things." The measure was found to have adequate reliability and validity in the general population (Bryant, 2003) and cronbach's alpha of .84 in the current study.

Weekly Pleasure Scale (developed for the study). Prior to each weekly LKM session, participants completed a 3-item self-report measure assessing their pleasure during the previous week resulting from interacting with people, recreational activities, and physical sensations. After each weekly LKM session, participants completed the same 3-item self-report measure pertaining to expectations of pleasure in the upcoming week. Participants indicated ratings on a 7-point scale ranging from no pleasure to strong pleasure. Cronbach's alpha was .76 for the past pleasure subscale and .86 for the future subscale.

Psychological/Social Resources & Recovery

Psychological Well Being (PWB; Ryff, 1989). The PWB is a self-report measure of well-being and consists of six subscales with a total of 54 items (medium length form based on full length 120 item scale). Participants indicated agreement on a 6-point scale (1 = strongly disagree, 6 = strongly agree) for items from the following 6 subscales: *Personal*

Growth, with items like “For me, life has been a continuous process of learning, changing, and growth"; *Environmental Mastery,* with items like “I often feel overwhelmed by my responsibilities” (reverse scored); *Autonomy*, with items like “I am not afraid to voice my opinions, even when they are in opposition to the opinions of most people”; *Self-Acceptance*, with items like “I like most parts of my personality”; *Purpose in Life,* with items like “My daily activities often seem trivial and unimportant to me” (reverse scored); and *Positive Relations with Others,* with items like “I know that I can trust my friends, and they know they can trust me.” Several of the PWB subscales, including *Purpose in Life*, *Environmental Mastery,* and *Self-Acceptance,* closely mirror the definition of “psychological recovery” as put forth by those experiencing severe mental illness (Andresen et al., 2003); therefore these scales from the PWB are considered a measure of psychological recovery. The internal consistency of these scales was acceptable in the current study except Personal Growth, which was removed from further analyses (Personal Growth=.27; Environmental Mastery=.81; Autonomy=.92; Self-acceptance=.88; Purpose in Life=.84; Positive Relations=.70; Total=.94).

Trait Hope Scale (THS; Snyder et al., 1991). The THS is a self-report scale that measures agency thinking and pathways thinking, the two cognitive components of hope theory. Participants used a four-point scale to indicate agreement or disagreement (1 = definitely false, 4 = definitely true) with 8 items divided between two subscales: *Agency Thinking* (belief that one has been / will be personally able to achieve one’s goals), including “I meet the goals I set for myself” and *Pathways Thinking* (belief that there are multiple ways to achieve one’s goals), including “There are lots of ways around any problem.” The THS was found to have good convergent and discriminant validity, internal reliability and support

for the two-factor structure in the general population (Snyder, Ilardi, Michael, & Cheavens, 2000). The internal consistency of this scale was borderline acceptable in the current study and as such, only the total score was used in further analyses (Agency=.66; Pathways=.66; Total=.72).

Satisfaction with Life Scale (SWLS; Diener, Emmons, Larsen, & Griffin, 1985). The SWLS is a 5-item scale that assessed participants' global satisfaction with their lives and circumstances. Participants indicated agreement on a 7-point scale with each item, including "So far I have gotten the important things I want in life." The single factor SWLS has good reliability and validity in the general population (Arrindell, Meeuwesen, & Huyse, 1991; Pavot & Diener, 1993) and has initial support for adequate psychometric properties with individuals with schizophrenia (Wu & Wu, 2008). In the current study, the internal consistency of this scale was .82.

Treatment Feasibility & Adherence

Attendance Tracking Form (developed for the study). Weekly attendance was recorded for each participant.

Meditation Practice Questionnaire (developed for the study). Prior to each weekly LKM session, participants were asked to complete a 3-item self-report measure assessing their LKM practice during the previous week (e.g. number of times they utilized the study CD to do LKM, number of different days they practiced, and average number of minutes practiced each day). These questions were also asked on the one- and two-month follow-up phone calls.

Stakeholder Feedback Form (developed for the study). This 10-item measure is divided into a quantitative and qualitative section that assessed the participants' satisfaction with the intervention as well as its perceived benefits. 6 quantitative self-report questions were rated using a 3-point Likert-type scale and 4 open-ended qualitative questions were asked by the clinical interviewer. Similar feedback questionnaires have been successfully used in other treatment development studies for individuals with schizophrenia (e.g. Penn, Roberts, Combs, & Sterne, 2007; Waldheter et al., 2008).

Intervention

LKM is a technique used to increase feelings of warmth and caring for self and others (Salzberg, 1995; Wallace & Shapiro, 2006). Similar to other meditation practices, LKM involves quiet contemplation, often with eyes closed or in a non-focused state and an initial attending to the present moment. Then participants directed their attention to their heart region and contemplated a person for whom they already feel warm, tender, and compassionate feelings (e.g., their child, a close loved one, a pet) or a situation when they felt warm feelings. They were then asked to extend these warm feelings to themselves. Often phrases such as "May I be safe" or "May I be at peace" were internally verbalized to help generate these feelings. As the practice continues, they were asked to radiate these warm, tender, and compassionate feelings to others; first to a few people they know well, then to all their friends and family; then to all people with whom they have a connection, and finally to all people and creatures of the earth. Although phrases and images may be repeated, these were used to generate positive emotions which are the intended focus of the participants' attention. The participants attended 6 one hour weekly sessions for 6 weeks and a review

session that took place 6 weeks after the final session. Each LKM session was conducted by a Masters-level licensed meditation facilitator, Mary Brantley, who has practiced for over 25 years and recently coauthored a book about LKM (Brantley & Hanauer, 2008).

The weekly group sessions incorporated 3 major components: discussion, skills teaching, and practice. At the beginning of each session the participants were encouraged to discuss something they learned from doing the meditation or a perceived benefit of the meditation. Problems, challenges, or questions about the practice were then addressed as a group with advice given to meet presented needs and reinforcement for positive aspects of the practice. Next, a mindfulness activity was taught and practiced, such as mindful eating, walking, listening or body movement. These practices were done to strengthen the participant's ability to concentrate in the present moment. This rationale was given to participants to help them see the ultimate goal of strengthening focus on loving-kindness. A novel aspect of loving-kindness meditation was then taught by the group leader who often used selected readings from books. Finally, the group facilitator led the participants in 5-10 minute LKM practices during the session, gently reminding participants to non-judgmentally redirect their attention to the feeling of loving-kindness when attention wandered. Participants were then encouraged to practice LKM formally by daily listening to a CD of the meditation, which contains 3 different sessions ranging from 15-25 minutes. Additionally, informal practice was suggested throughout the day for durations as short as a few minutes at prescribed times or when distressing situations arise.

Procedures

The current pilot study utilized a pre-post design without a comparison control group for an initial examination of the feasibility and potential clinical benefits of LKM for

individuals who have schizophrenia with persistent negative symptoms. This design was chosen over a quasi-experimental group or randomized control as this is a recommended first step in determining the feasibility of the intervention (Mueser & Drake, 2005). In addition, researchers disagree about the need for a control group when the outcomes being targeted are typically stable over time, such as persistent negative symptoms (Mueser & Drake, 2005).

Two different groups of 9 participants attended the LKM group weekly for 6 sessions lasting one hour each as well as a 6 week follow-up booster session. Participants were assessed by a trained rater at baseline, post-treatment, and 3-month follow-up on a number of outcomes previously described. Participants also received a one- and two-month follow-up phone call to ask about their meditation practice and serve as a reminder. All participants continued to receive usual medical care for their disorder throughout the intervention, including antipsychotic medication.

CHAPTER 3

RESULTS

Overview of Data Analyses

First, relevant data were examined to evaluate the feasibility and acceptability of the intervention. Qualitative feedback from participants was informally analyzed for themes relevant to any perceived benefits or dislikes of the intervention. Next, quantitative analyses (i.e. paired samples t-tests) were conducted with an emphasis on within-group effect sizes, and clinical significance for changes between: 1) baseline and post-test 2) baseline and three-month follow-up. This approach to analyses is consistent with previous treatment development research in severe mental illness (Mueser et al., 2007; Waldheter et al., 2008). However, statistical inferences should be made with great caution given the number of t-tests calculated and the associated inflation of type I error (as well as the small sample size).

Effect sizes were calculated by examining the magnitude of pre-post change correcting for the pooled standard deviation and the correlation of the outcome at both time points (Dunlap, Cortina, Vaslow & Burke, 1996; Cohen, 1988). Cohen's *d* value was evaluated according to standard criteria: small (*d* = .20), medium (*d* = .50), and large (*d* = .80).

Clinically significant change was determined using criteria refined by Jacobson and Truax (1991), which currently is the most commonly used method of calculating clinical

significance and has a more meaningful interpretation than statistical significance (McGlinchey, Atkins, & Jacobson, 2002). Clinical significance was calculated for each individual participant taking into account the standard deviation and test-retest reliability of the measure in normative samples. However, when this method was unable to be completed for a particular measure (e.g. limited normative data for the NSRS), then clinically significant change was evaluated according to criteria typically used in schizophrenia research (e.g., 20% reduction or improvement; Cather, Otto, Yovel, Mueser, & Goff, 2005).

Preliminary Analyses

The following results are based on the intent-to-treat sample, which included both treatment completers and non-completers (n=18). This is considered a more conservative estimate of the effects of the intervention given that the treatment non-completers received only a small dose of the intervention (i.e. 2 sessions). Independent sample t-tests comparing completers and non-completers found no differences on baseline variables or demographics (although this is based on a comparison of 16 versus 2 participants). Additionally, analyses of treatment completers alone (n=16) did not alter the pattern of results found when using the intent-to-treat sample. Finally, the two intervention cohorts did not differ significantly from one another on any demographic or baseline outcome variables. Therefore, they were combined for all subsequent analyses.

Analyses of the 3 month follow-up assessment are based on the first cohort only (n=9) as the second cohort is scheduled for that assessment at the end of June 2009. Results presented are based on a last observation carried forward procedure, due to one participant relocating out of the country prior to the 3 month assessment (e.g. Mueser et al., 2007).

Feasibility and Acceptability

Hypothesis 1 predicted that LKM would be feasible and acceptable based on attendance, attrition, and participant feedback. Figure 3 is a CONSORT diagram that summarizes the participant flow throughout the study. Eighteen participants received the intervention with 16 participants defined as treatment completers (i.e. attended 4 or more sessions) and 2 participants defined as treatment non-completers (i.e. attended fewer than 3 sessions). The intent-to-treat sample had an 84% attendance rate with an average of 5.06 sessions attended (*SD* = 1.35 range = 2-6). Treatment completers had an attendance rate of 91% with an average of 5.44 sessions attended (*SD* = .82; range = 4-6). Both treatment non-completers attended 2 sessions. During the 6 week intervention, treatment completers listened to an average of 1.6 tracks of the meditation audio CD per week. Treatment completers also practiced the meditation formally or informally for a mean of 3.73 days per week (SD=1.43) at an average of 19.06 minutes per practice (SD=14.55).

Treatment satisfaction scores in Table 2 suggest excellent acceptability of the intervention. Positive ratings were provided on all items including the ease of the meditation practices, perceived utility of LKM, and enjoyment of the group. Ratings were also positive for the perception that LKM helped participants look forward to being with people and enjoy things in life; however, most ratings for these items were not in the extreme positive category.

Feedback from the qualitative section of the Stakeholder Feedback Form provided a more personal perspective on what was enjoyed about the group and the perceived benefits of the intervention (although please note that formal qualitative analyses were not conducted). Participants most commonly reported enjoying a sense of peace and relaxation as a result of the LKM group and the meditation (n=10). Also, almost half of the participants reported

enjoying the social aspects of being in a group, including feeling supported, encouraged, and less distracted while meditating (n=8). Several participants also reported enjoying being able to attend to the present moment (n=4). The majority of participants reported experiencing some positive change in their life as a result of the intervention (n=15). Almost every participant reported unique changes including feeling more “peaceful”, “happy,” “empathic,” “able to access feelings of loving-kindness,” “alert,” and “able to focus.”

An obstacle reported by 3 participants was the experience of having difficulty or not agreeing with sending loving-kindness to all people of the world. Other challenges to using the meditation were finding time (n=2), remembering to practice (n=2), and difficulties concentrating (n=2). Three participants suggested making the intervention longer by increasing the session duration or the number of sessions.

The two treatment non-completers were both in the second cohort and each attended only two sessions (sessions 3 & 4). During the post-treatment assessment, the first participant indicated that he had wanted a group therapy where he would receive help for his individualized difficulties. He reported that he did not see any way that the meditation practice would assist him personally. The second participant was asked by the researcher to discontinue attendance due to his disruptive behavior in group. During the sessions, this participant often spoke negatively about his impressions of the meditation, stated that he was not practicing according to the instructions, and was oppositional towards the group facilitator. During the post-treatment assessment, the participant discussed enjoying the meditation but feeling paranoid as a result of the group being located in his mental health clinic. He also felt disrespected by the group facilitator, believing that the facilitator was

treating everyone at a low functioning level, and that he was being accused of using drugs or alcohol (which the Director of his clinic also suspected).

Clinical Outcomes

Table 3 summarizes the pre-post means and standard deviations, effect sizes, and statistically significant changes based on paired sample t-tests (note: Ns are different for post-test and 3-month follow up assessments, as the former is based on both cohorts one and two, while the latter is based only on cohort one). Table 4 displays the percentage of participants who experienced a clinically significant change on each primary clinical outcome.

Hypothesis 2 stated that participants should show increased positive affect at post-treatment and 3 month follow-up assessments following LKM. Analyses were based on 4 measures: 1. mDES (i.e. frequency of emotions during the previous 2 weeks) 2. DRM (i.e. intensity of emotions during the previous afternoon) 3. Informant mDES (i.e. informant ratings of the estimated emotions of the participants during the previous 2 weeks) and 4. Weekly Mood Scale (i.e. mood ratings before and after each LKM session).

The results of both the mDES and DRM revealed a large positive within-group effect size for participants' positive emotions at post-treatment and the 3 month follow-up. The results of the Informant mDES showed a medium positive within-group effect size for participants' positive emotions at the post-treatment assessment. Figure 4 illustrates the participants' mood ratings associated with each LKM session. The mean pleasant mood immediately before each LKM session was 2.59 (SD=.69) and after each LKM session was 2.99 (SD=.73). An ordered logistics regression found no statistically significant main effect

on positive mood for impact of session (i.e. pre or post), time (i.e. differences across the 6 sessions), or the interaction of the two variables. However, odds ratios found that an LKM participant was 2.84 times more likely to rate an increased pleasant mood after a LKM session. Analyses of clinical significance indicated that close to half of the participants experienced a 20% increase in positive emotions on the mDES and DRM at the post-treatment assessment. Overall, these data indicate an increase in participants' positive emotions after the treatment and persisting at the 3 month follow-up.

Hypothesis 3 stated that participants should experience decreased negative symptoms at post-treatment and 3 month follow-up assessments following LKM. Therefore, with-in group paired t-tests were conducted on the NSRS total score and on the planned subscales of "anhedonia" and "asociality." Large negative within-group effect sizes (which are in the expected direction) were found for total negative symptoms and anhedonia with reductions persisting at the 3 month follow-up. A medium negative within-group effect size was found for asociality at post-treatment and a small negative within-group effect size at the 3 month follow-up. Over two-thirds of the participants experienced a clinically significant reduction in anhedonia and total negative symptoms at the post-treatment assessment, while almost half of the participants experienced a clinically significant reduction in asociality.

Likewise, hypothesis 3 predicted increases in pleasure, specifically anticipatory pleasure as measured by the TEPS, SBI, and Weekly Pleasure Scale following LKM. With-in group paired t-tests conducted on the TEPS revealed no significant changes in participants' anticipatory pleasure at post-treatment and 3 month follow-up. However, the SBI anticipating subscale yielded a large positive effect size at the post-treatment with improvements

persisting at the 3 month follow-up assessment. The TEPS consummatory pleasure subscale also yielded a large positive effect size at the post-treatment and 3 month follow-up. In order to understand these mixed results, Table 5 presents the correlations among the anhedonia-related measures at baseline. The results indicate that the NSRS anhedonia scale and SBI anticipatory scale are significantly associated with one another. The TEPS subscales are significantly related to one another, but not with either the NSRS anhedonia scale or SBI anticipatory scale. These results suggest that the TEPS and SBI are measuring somewhat separate constructs.

Analyses of clinical significance indicate that approximately 20% of the sample experienced a 20% improvement on the TEPS consummatory pleasure subscale and the SBI anticipating subscale. On the Weekly Pleasure Questionnaire, mean pleasure experienced the week prior to each session was reported as 12.51 (SD=3.26) and mean pleasure expected from the upcoming week was 12.73 (SD=3.19). An ordered logistics regression found no statistically significant main effect of time (i.e. pre-post) or session (i.e. 1-6) on past or future weekly pleasure ratings. Overall, these data suggest improvements in negative symptoms after the treatment and persisting at the 3 month follow-up.

Hypothesis 4 stated that participants would experience improvements in psychological recovery at post-treatment and 3 month follow-up assessments following LKM. Analyses of the self-acceptance and environmental mastery subscales of the PWB revealed large positive effect sizes at post-treatment, with medium positive effect sizes on both subscales at the 3 month follow-up. The purpose in life subscale had mixed findings with a small positive effect size at post-treatment and a small to medium negative effect size

at the 3 month assessment. Therefore, participants' purpose in life increased immediately after the intervention but decreased after 3 months relative to baseline. Analyses of clinical significance indicate that approximately 20% of the sample experienced a 20% improvement on these target subscales of psychological well-being.

Analyses of participants' total hope score (i.e. THS) yielded a medium positive effect size at the post-treatment assessment which persisted at the 3 month follow-up assessment. Fifty percent of the participants experienced a clinically significant improvement in hope at the post-treatment assessment. Finally, a large positive effect size was found for participants' satisfaction with life (i.e. SWLS) at post-treatment and a medium positive effect size at the 3 month follow-up assessment. Ten percent of the sample experienced a clinically significant improvement in satisfaction with life at the post-treatment assessment, based on the Jacobson & Truax (1991) method; 50% of the sample experienced a 20% increase on this measure.

Exploratory Analyses

Exploratory analyses conducted on secondary clinical outcomes are summarized in table 6. A small positive effect size was found for the positive symptom total subscale of the BSI, indicating an increase in the number of symptoms observed at the post-treatment and 3 month follow-up assessments. However, a medium negative effect size was found for the symptom distress subscale of the BSI, indicating reductions in distress associated with symptoms at post-treatment and 3 month follow-up assessments. A medium to large negative effect size was found on the CDS, indicating a reduction in depression at the post-treatment assessment; however, only a small negative effect size was found at the 3 month follow-up. Analyses of additional subscales of the NSRS yielded large negative effect sizes for blunted

affect and alogia, suggesting reductions in these negative symptoms at the 3 month follow-up.

Six participants from the second cohort had informants (i.e. family or friends) complete a questionnaire at baseline and post-treatment. This questionnaire asked the informants about their interactions with the study participant the day prior to completing the questionnaire. The number of informants for each participant ranged from 1 to 3, with a median of 2. A majority of informants were female (60%) and family members of participants (80%) with a mean age of 51.27 years (SD=14.14). Table 6 summarizes the results of that questionnaire. Findings demonstrate a large positive effect size for the number of interactions occurring over a one day period. Also, a small positive effect size was found for the length of the most salient conversation over a one day period. No statistically significant changes are found on the informants' ratings of the quality of the relationship with study participants. Taken together, the results suggest that informants did notice an improvement in the number and duration of participants' conversations but no changes in the closeness of the relationship.

Exploratory bivariate correlations were computed between change scores on clinical outcomes from baseline to post-treatment so as to examine potential relationships consistent with the broaden-and-build theory of positive emotions (see Table 7). Exploratory hypotheses were that 1.) time spent meditating outside of sessions would be positively correlated with increased positive emotions 2.) increased positive emotions would be related to decreased negative symptoms and increased psychological recovery. Inconsistent with hypothesis 1, the amount of time participants spent meditating outside of the LKM sessions

was not significantly associated with changes in positive emotions from baseline to post-treatment. However, consistent with hypothesis 2, increases in positive emotions (i.e. on the mDES) were significantly associated with reductions in target negative symptoms (correlations ranged from -.58 to -.79), and increases on scales representing psychological recovery (.47 to .77). Changes in positive emotions were not significantly associated with changes on anticipatory or consummatory pleasure. Given the small N, and the fact that these are not mediation analyses, these findings should be interpreted cautiously.

CHAPTER 4

DISCUSSION

In accordance with treatment development procedures, this uncontrolled pilot study aimed to evaluate the feasibility and acceptability of LKM with individuals with persistent negative symptoms of schizophrenia. Consistent with our hypotheses, LKM was found to be well tolerated with high attendance and low attrition. Next, it was predicted that participants would experience an increase in positive emotions, reduction in negative symptoms, and increase in psychological recovery. Initial results supported these hypotheses and suggest that LKM may be a promising treatment for this clinical population. Findings are discussed in further detail below.

Feasibility and Acceptability

LKM was associated with a high level of interest and attendance. Over 85% of the referrals were interested in receiving more information about the group. Even when individuals who did not answer the phone or return voice messages are included, the remaining 2/3 of the individuals referred for the study were interested in participating. Similarly, an attendance rate of 91% for treatment completers with 11% attrition rate is considered well-tolerated and a necessary condition for further testing of an intervention (Mueser & Drake, 2005). For comparison, a pilot study of group mindfulness meditation for individuals with schizophrenia (also 6 sessions) had a similar attendance rate (86%) but a

higher attrition rate (27%) (Lavey et al., 2005). Further empirical studies of meditation interventions may find high rates of attendance, which is consistent with previous research establishing high rates of self-reported alternative medicine practice within the psychiatric population (Russinova et al., 2002).

Self-report of LKM practice outside of session also suggests treatment engagement given that participants practiced regularly (i.e. almost 4 days per week). However, self-report of LKM practice should be interpreted cautiously due to experimenter demand effects. Future studies may include more ecologically valid measures of practice such as Computerized Ecological Momentary Assessment (EMAc; Granholm, Loh, Swendsen, 2008). This is particularly relevant for LKM as results suggest that participants often practiced informally (i.e. various times throughout the day without the CD), which may be more difficult to recall than formal practices (i.e. prescribed times using the CD).

Intervention feedback provided by participants supports the acceptability and perceived utility of LKM. All participants reported finding the group useful and a majority stated that it was very enjoyable. Reports of increased relaxation as well as improved concentration and awareness of the present moment are consistent with qualitative findings from a pilot study of group mindfulness for psychiatric inpatients (York, 2007). Additionally, almost half of the sample reported enjoyment from the group alliance, which may be an important factor given the positive relationship between group alliance and attendance rate (Johnson, Penn, Bauer, Meyer, & Evans, 2008). Future research should also include quantitative measures of relaxation, mindfulness, and group alliance to measure changes in these outcomes as well as test them as mediators.

Clinical Outcomes

While these outcome data must be interpreted with great caution, results were consistent with hypotheses based on previous research and on the broaden-and-build theory. LKM was associated with an increase in participants' positive emotions from baseline to post-treatment assessments, which is consistent with the studies of LKM in non-psychiatric populations (Fredrickson et al., 2008; Hutcherson et al., 2008). The results of this study are particularly strong given the significant findings from three different measures of positive emotions, one of which was rated by informants. Further testing of the intervention should investigate whether the persistence in increased positive emotions after the intervention is due to continued LKM practice by participants (maintenance effect). Longitudinal analyses of the Frederickson et al. (2008) study of LKM found that participants who continued to practice meditation at least occasionally reported more positive emotions at a one year follow-up than non-continuers (Cohn & Fredrickson, 2009). It may also be that 6 sessions of the intervention was a sufficient "dose" of treatment to initiate the "upward spiral" effects of positive emotions. This would be consistent with previous research indicating positive emotions predict increases in future positive emotions, partly through positive coping and interpersonal trust (Burns, Brown, Sachs-Ericsson, Plant, Curtis, Fredrickson, et al., 2008; Fredrickson & Joiner, 2002).

No significant changes were found on the Weekly Mood Scale; however, inspection of the results suggests a ceiling effect given the skewed data. Future testing should involve expanding this likert-type scale's response choices from 4 to 10, potentially increasing the measure's variability.

LKM was also associated with a large decrease in participants' total negative symptoms and anhedonia with smaller reductions in asociality. These findings are consistent with previous research demonstrating that LKM improved social support and positivity towards others in non-clinical samples (Fredrickson et al., 2008; Hutcherson et al., 2008). Data collected from participant informants suggest increased social interactions both in quantity and duration after the 6 week intervention, which is consistent with the observed decrease in asociality. Although there was not an improvement in the quality of the relationship with informants, 6 weeks may be a limited amount of time to observe noticeable changes in this domain. This finding is also consistent with recent longitudinal analyses of an LKM intervention (Fredrickson et al., 2008), which found that participants who continued their meditation practice did not experience closer relationships with informants compared to those who discontinued practice after the intervention (Cohn & Fredrickson, 2009). Further research should explore whether reductions in asociality are limited to increased interactions with others but not necessarily increased closeness. Additionally, reductions in alogia and blunted affect were found at both post-treatment assessments, which would be expected given the changes in other negative symptoms and the inter-relationships amongst these factors (Wolf, 2006). Analyses specific to avolition could not be conducted due to low reliability and further testing is therefore warranted.

As part of the previous hypothesis, it was expected that changes in anhedonia would be specific to anticipatory pleasure and not consummatory pleasure. This hypothesis was partially supported as participants' scores on the SBI anticipating subscale significantly improved after LKM, consistent with previous research within a non-psychiatric sample (Fredrickson et al., 2008). This improvement would be expected according to the broaden-

and-build theory given the increase in positive emotions, which builds resources such as anticipatory pleasure.

However, no changes were found on the TEPS anticipatory pleasure subscale, which has been validated in this clinical population. There are some possible explanations for the inconsistency in findings across these measures. First, the TEPS was developed to be a trait measure of pleasure and therefore items may not be sensitive to changes in pleasure over a shorter period of time. This differs from the SBI, which is a state measure of people's beliefs about their ability to savor future events. In fact, the author of the SBI recommends its use for evaluating therapeutic interventions like LKM, which are designed to enhance savoring (Bryant, 2003). Second, the TEPS intentionally assesses only a single domain of pleasure (i.e. physical), whereas the SBI assesses overall pleasure regardless of domain. Therefore, it is possible that participants' experienced improvements in other domains of anticipatory pleasure beyond physical pleasure (i.e. social, recreational, occupational), which may also account for the lack of correlation between the measures.

No changes were found on the Weekly Pleasure Scale, which was not consistent with our hypotheses. However, the Weekly Pleasure Scale was developed for this study as an adaptation from the NSRS anhedonia subscale and therefore further testing needs to be conducted to establish its basic psychometric properties.

Finally, it should be noted that participants did experience a significant improvement on the TEPS consummatory pleasure subscale, which was not predicted. This may be due to regression to the mean, given that participants in this pilot study yielded a baseline mean below that of the sample used for validating the TEPS with schizophrenia-spectrum disorders (Gard et al., 2007). It is also possible that LKM builds the potential to experience pleasure in

the moment for those who are particularly lacking in that capacity. Further testing should explore this finding with a larger sample and through cross validation with the SBI present savoring subscale.

LKM was associated with an increase in participants' psychological recovery, which is consistent with the research on LKM in non-psychiatric samples. Participants' improvement on the Psychological Well Being (PWB) Scale indicated that they were more accepting of themselves, which includes strengths and limitations, and more in control of their life routine and responsibilities. These findings are consistent with previous qualitative research that psychiatric inpatients applied mindfulness to regulate their life, become self-reliant, and decrease self-judgments (York, 2007). Participants in the current pilot study were also more hopeful and satisfied with their life after the intervention; results consistent with previous research in non-clinical samples (Fredrickson et al., 2008; Sears & Kraus, 2009). Further research should assess whether these changes are due to the building of positive emotions, which would be consistent with previous research in non-psychiatric samples and the broaden-and-build theory.

Inconsistent with hypotheses, participants did not experience improvement in purpose in life. It should be noted that although the measures of psychological recovery had adequate internal reliability in the current study, none of the subscales have been validated for use with schizophrenia-spectrum disorders. Therefore, further research needs to first establish the validity of the Purpose in Life subscale before using it in further testing of LKM for this population. Visual inspection of the baseline means for the PWB subscales also shows that participants had elevated levels of purpose in life as compared to the other subscales. Therefore, non-significant changes on the Purpose in Life subscale may be the result of

unintentionally selecting a sample of participants who were content with their purpose in life and not seeking changes in that domain (one of the limitations of a small sample). Normative data on this subscale from the medium form length of the PWB is limited, which prevents further exploration of this unexpected finding.

Exploratory analyses revealed patterns of findings consistent with the primary outcomes and with previous research. Participants experienced a slight increase in symptoms of psychopathology; however, these symptoms were associated with less distress at both post-treatment assessments. Previous research on another mindfulness-based intervention (i.e. ACT) has demonstrated similar findings in schizophrenia, which the authors posit are due to enhanced awareness but reduced emotional attachment to symptoms (Guadiano & Herbert, 2006). Participants also reported less symptoms of depression after the intervention, which is consistent with previous research on LKM with a non-psychiatric sample (Frederickson et al., 2008). It should be noted that this reduction in depression is not likely accounted for by changes in anhedonia, as these are found to be distinguishable factors in schizophrenia (Horan et al., 2006). Instead, future research should replicate the findings of Fredrickson et al. (2008), which supported the theory that increased positive emotions led to decreased depression partly through building of resources.

Finally, exploratory correlations computed between outcome change scores were generally consistent with the broaden-and-build theory but should not be interpreted as inferring support for the theory. Increased positive emotions from baseline to post-test were found to be associated with decreased negative symptoms and increased psychological recovery, which is consistent with research on LKM using a non-clinical sample (Fredrickson et al., 2008).

However, there were two unexpected results based on the exploratory correlations. First, longer length of time spent meditating outside of session was not associated with increased positive emotions at the post-treatment assessment. This finding may be due to the averaging of meditation practice across all 6 weeks, which does not capture changes in practice over time. Indeed, Fredrickson et al. (2008) found a dose-response relationship between the practice of LKM and the experience of positive emotions which tripled from the initial weeks to the final week of the intervention. Second, positive emotions were not significantly correlated with anticipatory or consummatory pleasure on the TEPS. This finding is consistent with research on the validation of the TEPS (Gard et al., 2006). However, changes in positive emotions were also not significantly correlated with the SBI. This finding is inconsistent with previous research demonstrating that LKM increased positive emotions, which then led to improvements in anticipatory pleasure (Frederickson et al., 2008). However, this previous research used meditational models compared to the current study's simple correlations. Indeed, other research on the SBI has demonstrated only a modest correlation between happiness intensity and anticipatory pleasure (Bryant, 2003).

Study Limitations and Future Directions

The current pilot study had several limitations that should be noted. First, the uncontrolled study design precludes any causal inferences about the efficacy of LKM. One possible confounding variable is season, given that both cohorts began the intervention during the winter and finished at the start of spring. Previous research has demonstrated a relationship between warmer weather and improved mood that is unique to spring, likely because individuals have been deprived of good weather during the winter (Keller,

Fredrickson, Ybarra, Cote, Johnson, Mikels, et al., 2005). Second, the small sample size precluded meditational analyses to test causal hypotheses and limited the power to detect changes in some variables (e.g. Weekly Mood Scale). Third, the primary measure of negative symptoms was a semi-structured interview administered by a researcher who was not blind to the study hypotheses, which has been identified as a key source in over-estimating the effects of a treatment (Tarrier & Wykes, 2004). And fourth, self-report measures, which constitute the majority of the assessment battery, are susceptible to demand effects, social desirability, and recall bias (Larsen & Fredrickson, 1999).

Changes to the intervention should also be considered based on qualitative feedback provided by participants. A few participants expressed difficulty or disagreement with sending loving-kindness to all people of the world. Some participants reported being confused as to how this would help others while other participants did not believe that all people deserved to receive loving-kindness, depending on their moral standing. It is recommended that future applications of the intervention involve more discussion of the rationale for this aspect of LKM. It can be clarified that sending loving-kindness to all people of the world is not intended to alter those people but instead to help the person practicing LKM. A few participants also suggested lengthening the intervention; however, the majority seemed content with 6 hour-long sessions and future testing will likely keep this consistent with the current pilot study.

In closing, this study showed that LKM is a feasible and acceptable intervention for individuals with persistent negative symptoms of schizophrenia-spectrum disorders. It is hoped that upcoming research will support the preliminary clinical benefits found in this pilot

study and that LKM will become an effective tool to help individuals with schizophrenia on their journey of recovery.

Table 1

Baseline characteristics of sample for LKM pilot study (n = 18)

Gender (*n*)	
Males	15
Females	3
Ethnicity (*n*)	
Caucasian	13
African-American	2
Bi-racial	3
Age (years)[a]	29.39 ± 10.24
Education (years) [a]	14.17 ± 2.04
IQ (WASI) [a]	112.00 ± 14.47
Unemployed (*n)*	10
Marital status (*n*)	
Never married	17
Divorced	1
Primary diagnosis (*n*)	
Schizophrenia	8
Schizoaffective	6
Psychosis NOS/Schizophreniform	4
Time since onset of illness (years)[a]	4.78 ± 6.03

[a] *M* ± *SD*.

Table 2

Feedback on LKM from intent-to-treat sample (n=18)

Item	Response [a] "1" n (% of respondents)		"2" n (% of respondents)		"3" n (% of respondents)	
How easy was it to follow the meditation exercises?	1	6%	7	39%	10	56%
How much did you enjoy this group?	0	0%	6	33%	12	67%
How useful was the group to you?	0	0%	10	56%	8	44%
Were the meditation exercises respectful to you as an individual?	0	0%	10	56%	8	44%
How much did the group help you in looking forward to being with people?	2	11%	12	67%	4	22%
How much did the group help you enjoy things in your life?	0	0%	13	72%	5	28%

Note. [a] All items were rated from 1-3, with 1 indicating most negative response (e.g., "not at all easy," "not at all useful," and 3 indicating most positive response (e.g., "very easy to follow," "very useful")

Table 3

Primary Outcomes: Intent-to-treat sample (Pre-test & Post-test: n=18; 3 month follow-up: n=9)

Variable	Pre-test M (SD)	Post-test M (SD)	*d*	3 month follow-up [a] M (SD)	*d*
mDES: Positive	1.50 (.59)	1.78 (.66)*	.78	1.85 (.85)	.89
DRM: Positive [b]	2.05 (.50)	2.37 (.88)*	.96	2.39 (.80)	1.26
Informants' mDES: Positive [c]	2.40 (.48)	2.52 (.86)	.50	N/A	
NSRS Total	60.83 (11.17)	44.89 (15.40)*	1.68	50.33 (12.84)*	1.50
Anhedonia	20.94 (5.88)	14.11 (4.81)*	1.88	16.00 (4.5)*	2.40
Asociality	7.78 (2.96)	6.67 (3.14)	.53	7.67 (3.43)	.23
TEPS: Anticipatory	4.01 (.67)	4.03 (.79)	.06	3.92 (.88)	.09
Consummatory	3.84 (.99)	4.30 (.75)*	.93	4.18 (1.09)	.77
SBI: Future	4.39 (8.48)	8.11 (8.44)*	.75	9.44 (8.66)	.83
PWB: Self-Acceptance	25.67 (8.40)	30.56 (10.67)*	.80	30.44 (11.19)	.50
Environ. Mastery	29.56 (8.05)	33.17 (9.22)*	1.04	34.22 (8.54)	.54
Purpose in Life	32.33 (9.22)	33.11 (8.88)	.20	34.44 (7.56)	-.37
THS Total [d]	20.59 (3.86)	21.79 (5.13)	.47	22.56 (4.45)	.59
SWLS [d]	13.94 (6.03)	16.82 (6.42)*	.86	18.78 (7.17)	.63

Note. A positive effect size indicates improvement, and a negative effect size indicates deterioration.

* statistically significant change on paired samples t-test ($p<.05$)
[a] effect size and statistical significance based on means for first cohort (n=9; LOCF for 1 participant)
[b] n = 16 (measure intentionally not given to 2 participants due to fatigue from the assessment battery)
[c] n = 6 (average of informant responses for 6 participants from second cohort)
[d] n = 17 (measure unintentionally not given to one participant)

mDES= Modified Differential Emotions Scale; DRM= Day Reconstruction Method; NSRS= Negative Symptom Rating Scale; TEPS= Temporal Experience of Pleasure Scale; SBI= Savoring Beliefs Inventory; PWB= Psychological Well-Being Scale; THS= Trait Hope Scale; SWLS= Satisfaction with Life Scale

Table 4

Number of participants with clinically significant change on primary outcome variables at the post-treatment assessment (n=18)

	Equation based (% of sample)	20% change (% of sample)
mDES Positive Emotions	N/A	9 (50%)
DRM Positive Emotions [a]	N/A	7 (44%)
NSRS Total	N/A	12 (67%)
Anhedonia	N/A	13 (72%)
Asociality	N/A	8 (44%)
TEPS: Anticipatory	5 (28%)	1 (6%)
Consummatory	6 (33%)	4 (22%)
SBI Future	2 (11%)	3 (17%)
PWB Self Acceptance	N/A	4 (22%)
Environmental Mastery	N/A	3 (17%)
Purpose in Life	N/A	5 (28%)
THS [b]	9 (53%)	5 (29%)
SWLS [b]	2 (12%)	8 (47%)

Note. Equations from Jacobson & Truax (1991) were used to calculate clinical significance when sufficient normative data were available. Additionally, participants with a 20% change on the measures are presented indicating improvement on those measures (per convention, e.g., Cather et al., 2005).

[a] n = 16 (measure intentionally not given to 2 participants due to fatigue from the assessment battery)

[b] n = 17 (measure unintentionally not given to one participant)

mDES= Modified Differential Emotions Scale; DRM= Day Reconstruction Method; NSRS= Negative Symptom Rating Scale; TEPS= Temporal Experience of Pleasure Scale; SBI= Savoring Beliefs Inventory; PWB= Psychological Well-Being Scale; THS= Trait Hope Scale; SWLS= Satisfaction with Life Scale

Table 5

Bivariate correlations computed among measures of anhedonia at baseline

	TEPS Anticipatory Pleasure	TEPS Consummatory Pleasure	SBI Anticipating
NSRS Anhedonia	-.21	-.40	-.54*
SBI Anticipating	.11	.28	
TEPS Consummatory Pleasure	.61*		

* $p<.05$

NSRS= Negative Symptom Rating Scale; TEPS= Temporal Experience of Pleasure Scale; SBI= Savouring Beliefs Inventory

Table 6

Exploratory Outcomes: Intent-to-treat sample (Pre-test & Post-test: n=18; 3 month follow-up: n=9)

Variable	Pre-test M (SD)	Post-test M (SD)	*d*	3 month follow-up (n=9)[b] M (SD)	*d*
BSI: Symptom Severity	1.00 (.68)	1.00 (.75)	-.01	.96 (.58)	-.20
Symptom Total	24.56 (13.06)	26.89 (13.34)	-.27	27.00 (13.20)	-.33
Symptom Distress	2.01 (.61)	1.74 (.72)*	.69	1.76 (.44)	.47
CDS	5.83 (4.00)	4.61 (3.97)*	.70	4.11 (4.57)	.15
NSRS: Blunted Affect	15.00 (5.45)	11.11 (5.91)*	.99	11.78 (4.55)	1.18
Alogia	5.67 (3.33)	4.44 (3.58)	.64	5.56 (3.21)	.93
Informants: # of Interactions[a]	6.17 (7.33)	7.38 (8.86)	1.22	N/A	
Interaction length (mins.)[a]	18.38 (21.1)	24.17 (21.79)	.27	N/A	
Quality of relationship[a]	3.97 (.52)	3.93 (1.06)	-.11	N/A	

Note. A positive effect size indicates improvement, and a negative effect size indicates deterioration.

* statistically significant change on paired samples t-test ($p<.05$)
[a] n = 6 (average of informant responses for 6 participants from second cohort)
[b] effect size and statistical significance based on means for first cohort (n=9; LOCF for 1 participant)

BSI= Brief Symptom Inventory; CDS= Calgary Depression Scale; NSRS= Negative Symptom Rating Scale mDES= Modified Differential Emotions Scale

Table 7

Bivariate correlations computed between change scores of positive emotions and changes scores of primary outcomes (baseline to post-treatment assessment; n=18)

	mDES Positive Emotions
Minutes spent meditating outside of session (averaged across week)	.08
NSRS Total	.79**
Anhedonia	.58*
Asociality	.65**
TEPS: Anticipatory Pleasure	.09
Consummatory Pleasure	.32
SBI: Future	.11
PWB: Self Acceptance	.47*
Environmental Mastery	.48*
Purpose in Life	.77**
THS [a]	.71**
SWLS [a]	.73**

Note. A positive correlation indicates positive emotions are associated with improvement, and a negative correlation indicates positive emotions are associated with deterioration.

* p<.05
** p<.01
[a] n = 17 (measure unintentionally not given to one participant)

mDES= Modified Differential Emotions Scale; NSRS= Negative Symptom Rating Scale; TEPS= Temporal Experience of Pleasure Scale; SBI= Savoring Beliefs Inventory; PWB= Psychological Well-Being Scale; THS= Trait Hope Scale; SWLS= Satisfaction with Life Scale

Figure 1. Anticipatory pleasure model of negative symptoms.

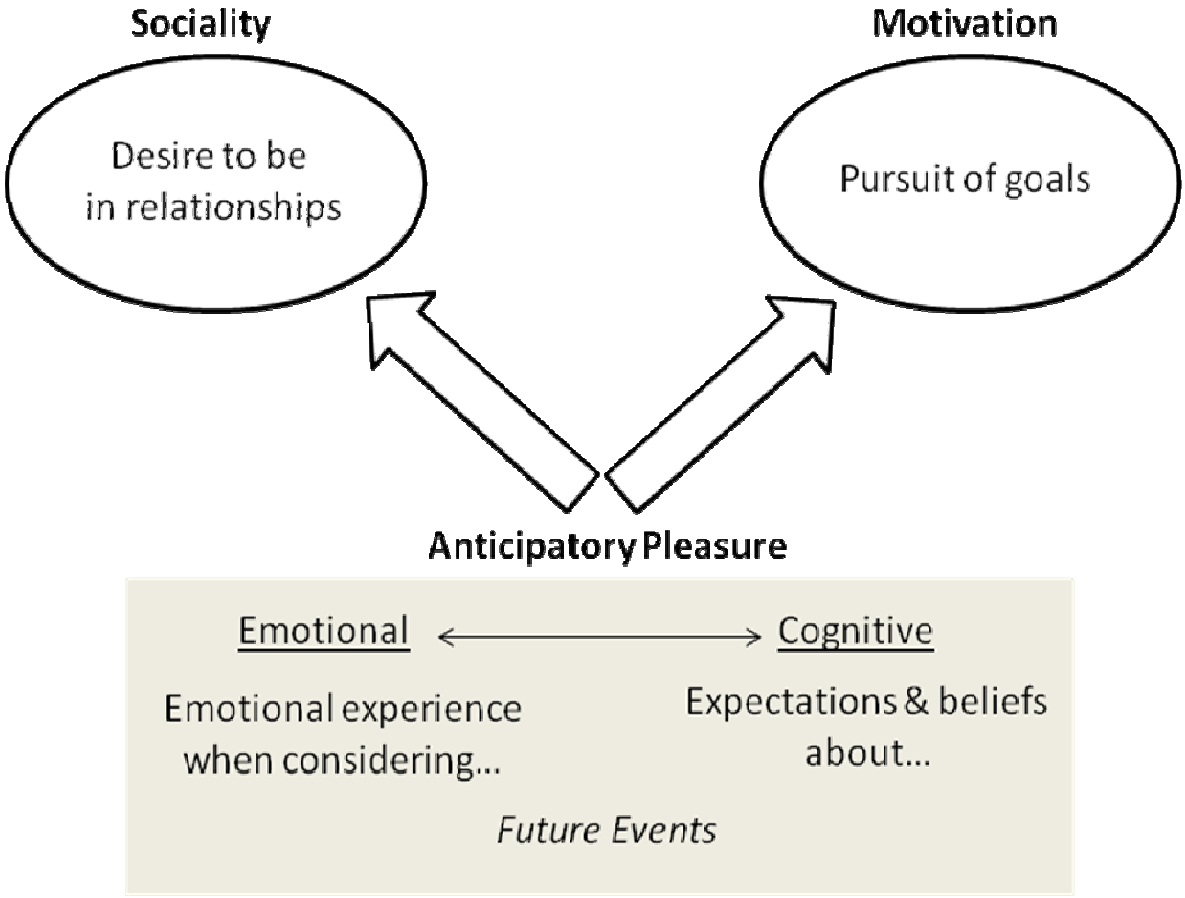


Figure 2. The broaden-and-build model of positive emotions as applied to the effects of LKM on the improvements in negative symptoms and psychological recovery of individuals with schizophrenia (modified from Fredrickson et al., 2008).

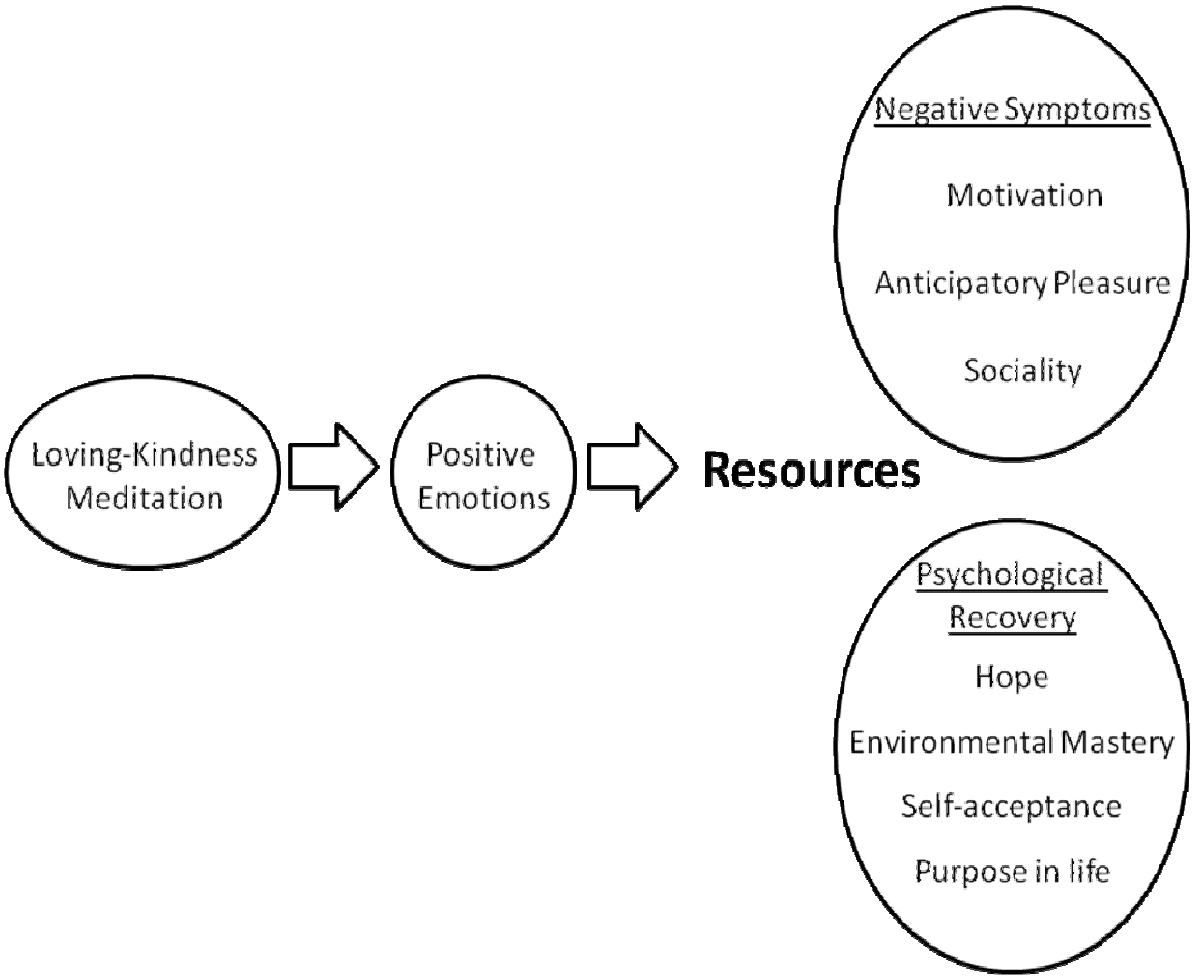


Figure 3. CONSORT diagram.

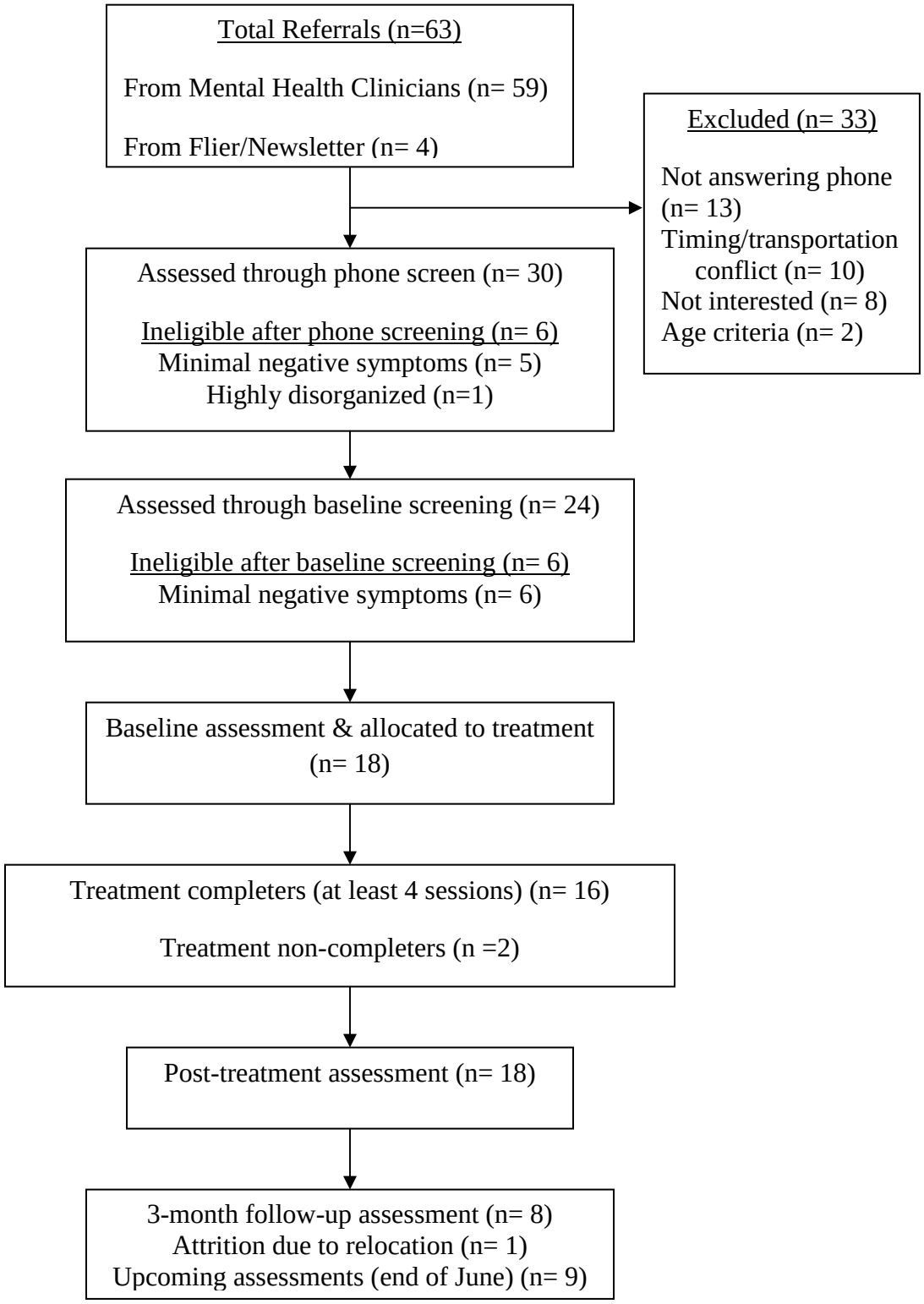
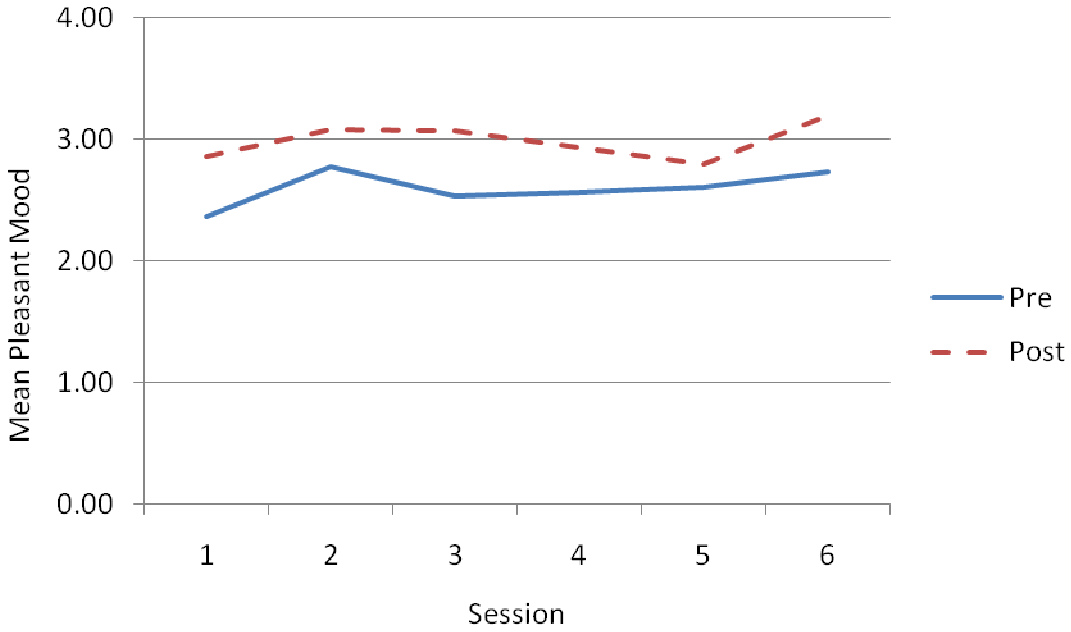


Figure 4. Mean weekly pleasant mood ratings before and after each LKM session



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